

3D Metallic Photonic-Crystals and its Energy Consequences

S.Y. Lin, T.M. Lu, D.X. Ye, J.A. Bur and P. Dutta

Rensselaer Polytechnic Institute, CII Room 6013, 110 8th Street, Troy, New York,
12180, USA

A review will be given on the recent development of 3D all-metallic photonic-crystals at the near-infrared and visible wavelengths. The energy consequences of the narrow-band lattice emission will be described. Three specific examples are (1) the realization of efficient infrared light sources; (2) the material challenges and nano-fabrication of photonic-crystals at near visible wavelengths; as well as (3) an efficient and portable electric power generation via long wavelength photo-voltaic (PV) cells.

In addition to the narrow-band photonic-crystal emission, we have developed photo-voltaic cells using a new InGaSb material. We show that the achieving greater than 20-30% optical-to-electric energy conversion efficiency is possible. Secondly, by incorporating different metals onto a 3D photonic-crystal, we demonstrated a photonic band-edge at the near visible wavelength of $\sim 700\text{nm}$. Experimental results from different metal coating, including Pt, Co and Cu, will be presented. Finally, a new technique for realizing 3D photonic-crystals using glancing angle deposition technique will be described. We will report a critical advance of the technique, namely maintaining the size/diameter of the spiral structure.